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A STUDY OF THE LIBERATION OF MINERAL PHASES DURING PROCESSING OF PHOSPHATE ROCK FROM NIGER

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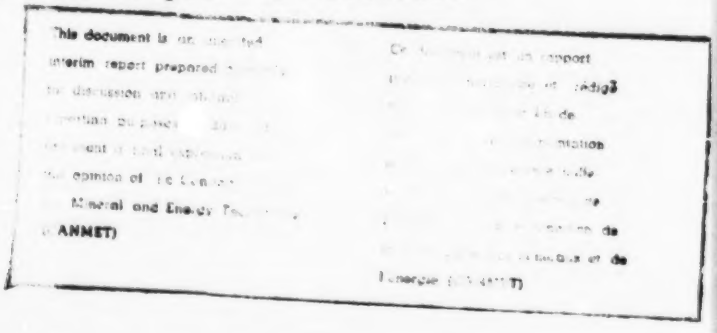
MICROMEDIA

This report relates essentially to the samples as received.



MINERALS RESEARCH PROGRAM

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A STUDY OF THE LIBERATION OF MINERAL PHASES DURING PROCESSING OF PHOSPHATE ROCK FROM NIGER

by

J.A. Soles* and W.A. MacDonald**

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INTRODUCTION

Samples of different screen fractions of a phosphatic sandstone from the Republic of Niger, prepared for flotation processing by the Mineral Dressing Section of the Ore Processing Laboratory, were examined under the stereomicroscope and particle counts were made to determine the size range at which the phosphate and associated minerals were mostly liberated. In addition, an unknown contaminant was analyzed.

EXPERIMENTAL RESULTS

The mineralogy and texture of the rock has been described previously[1] from a study of thin sections and by X-ray analysis. The principal constituents of the sample are quartz and apatite. Comminution has freed phosphate nodules and the frosted quartz grains along weak grain boundaries, but some of the fragments contain remnants of both phases in each other, even below the 200-mesh size. The photomicrographs in Figure 1 show the mineralogy

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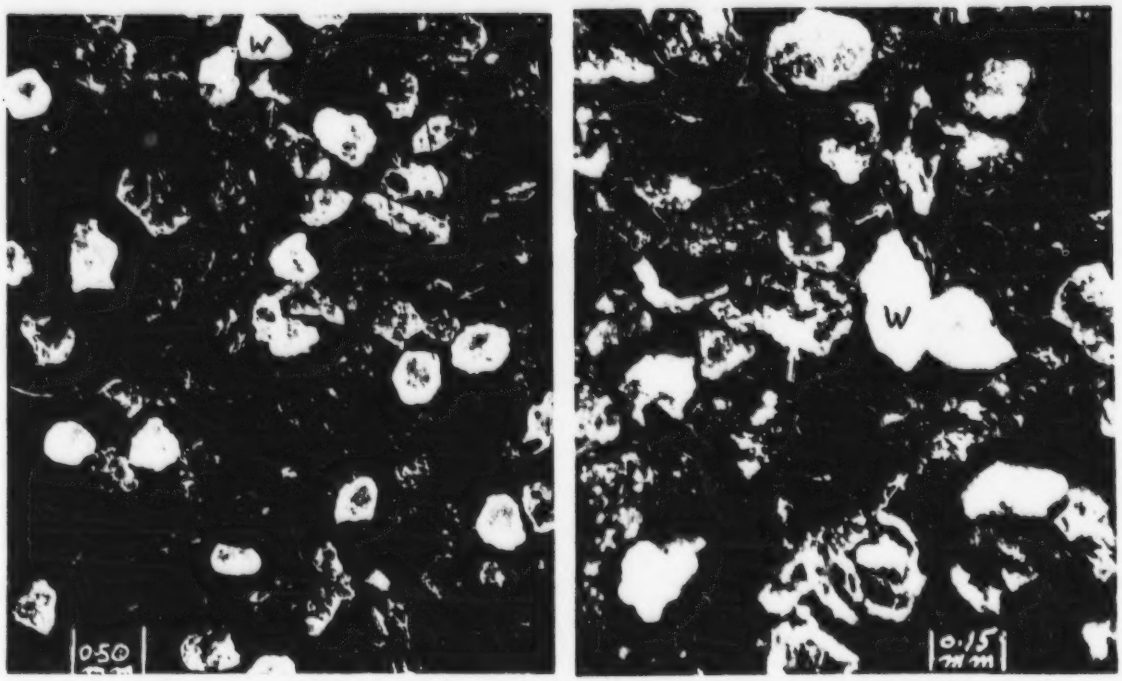
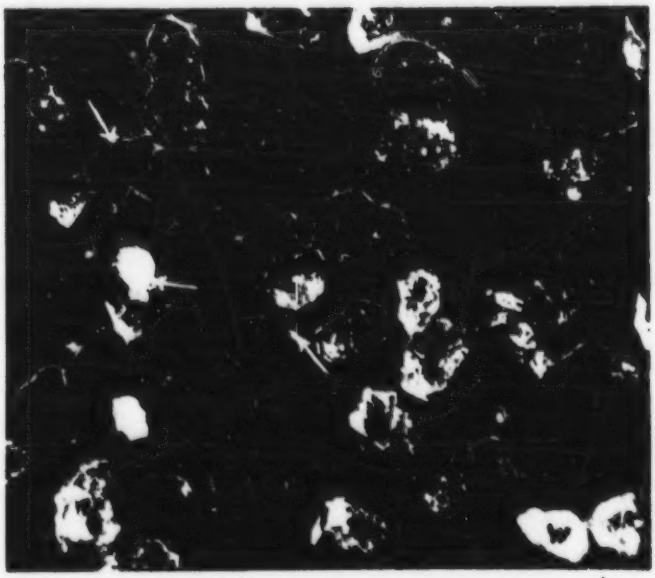


A. Tyler mesh (-48+65)

B. Tyler mesh (-65+100)



C. Tyler mesh (-150+200)

Figure 1. Photomicrographs of particles in different screen fractions of crushed phosphatic sandstone from Niger. Quartz is translucent white, phosphate nodules and fragments are light to dark grey, unknown is white (W). Locked quartz + phosphate particles are arrowed (↗).

of particles in different size fractions, and the histogram in Figure 2 gives the results of particle count analyses of phases in four of the fractions.

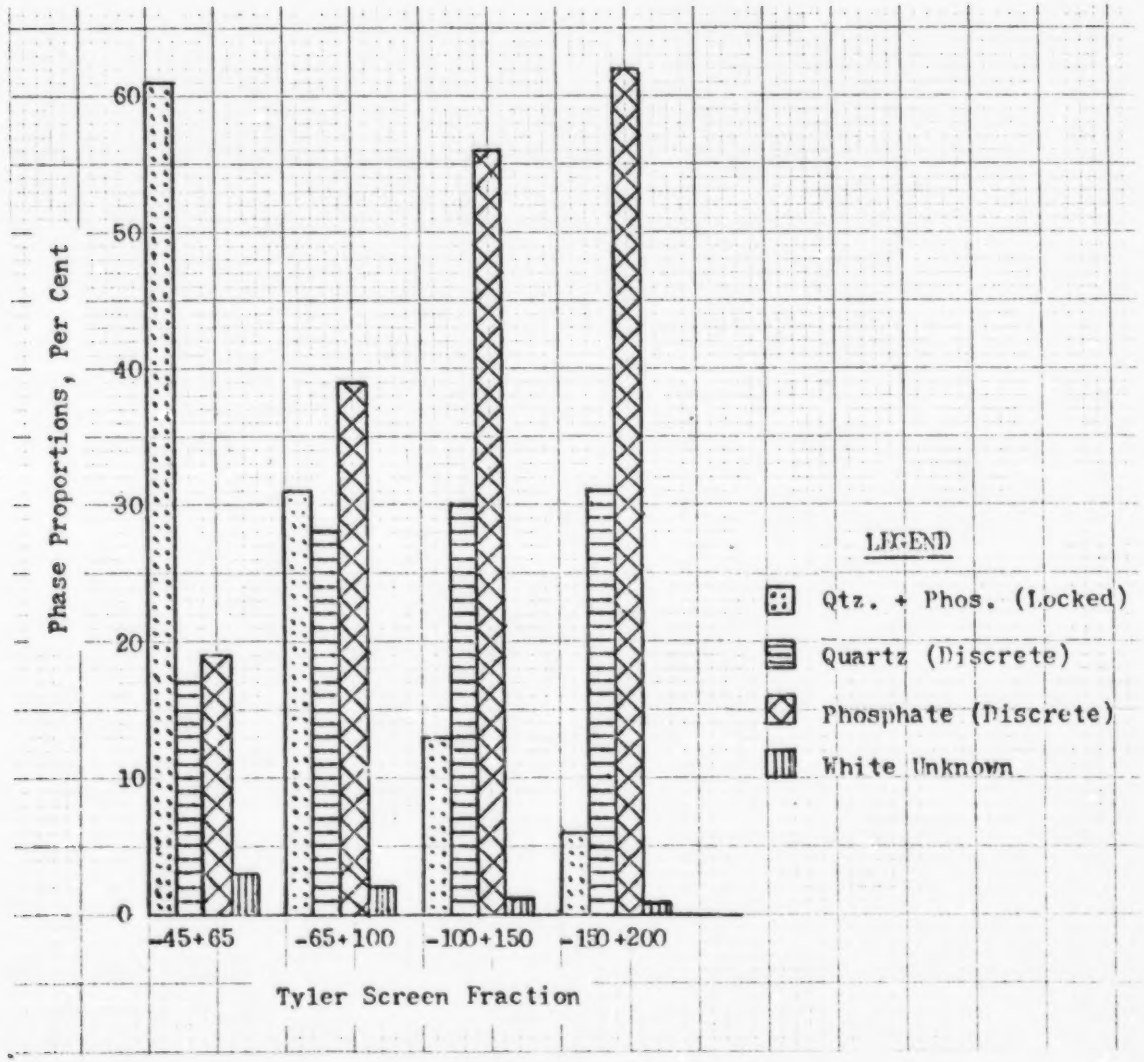


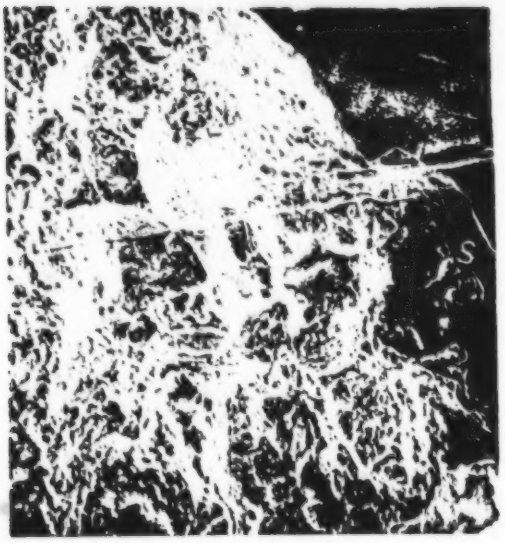
Figure 2. Mineralogical analyses of sized fractions of Niger phosphatic sandstone.

Selected grains of slightly friable white particles, which concentrated in the phosphate sink product up to a maximum of 6 per cent by volume, were examined. Quartz is abundant within the particles as rounded grains or anhedral masses, but the aphanitic matrix surrounding it is mixture of phases. Petrographic study of fragments showed that isotropic material (Refractive Index ≈ 1.51) and an anisotropic mineral (R.I. ≈ 1.58) were present. An X-ray energy dispersive spectrum (Figs. 3, 4) obtained of the matrix with a scanning electron microscope* revealed that aluminum and phosphorus are the principal constituent elements, which suggests that at least one phase is an aluminum phosphate. A Guinier-deWulff X-ray diffraction pattern revealed that variscite ($AlPO_4.2H_2O$) was probably present, but other lines could not be identified.

CONCLUSIONS

This study indicates that crushing the Niger phosphatic sandstone to minus 100 Tyler mesh (<150 μm) should free sufficient phosphate to obtain a good concentrate, with an acceptable recovery. Deleterious amounts of aluminum should not appear in the phosphate fraction if the white fragments were the only source of Al; however, chemical analyses of the concentrate fractions are required to confirm that the content is within tolerable limits, that is, <3% ($Al_2O_3 + Fe_2O_3$)[2].

*Cambridge Instruments Mk IIA Stereoscan, with Ortec 6200 Analyzer.



A. Magnification X200

B. Magnification X500

Figure 3. Scanning electron photomicrographs of particle of the white material observed in the Niger phosphatic sandstone, showing nodular to fibrous or structureless forms. Quartz occurs within the particles both as detrital grains and as interstitial cherty masses (Q).

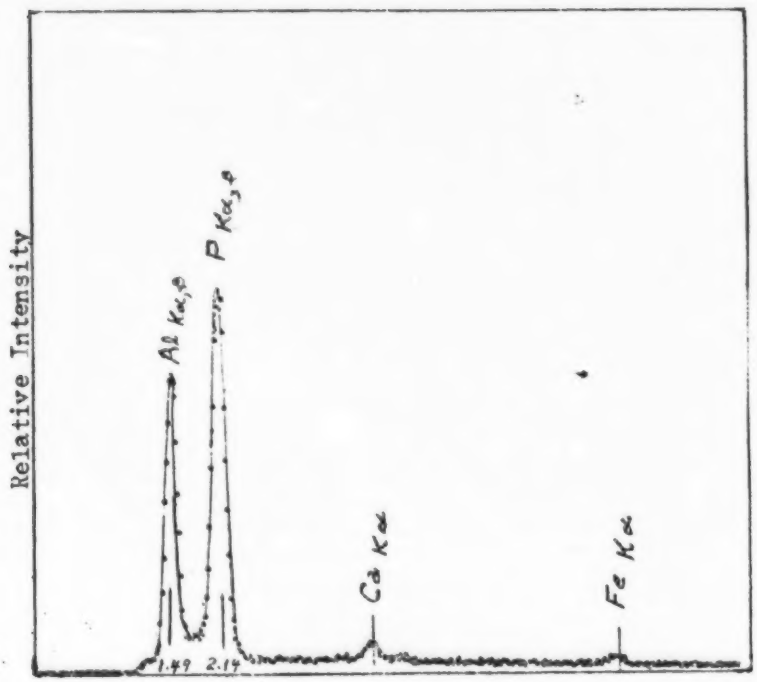


Figure 4. Scanning electron microscope X-ray energy dispersive spectrum of a quartz-free area of the particle shown in Fig. 3. The principal phase is an aluminum-phosphorus compound.

REFERENCES

1. Buchanan, R.M. "Microscopic examination of two specimens of Niger phosphate"; Memorandum, p 3, Dec. 20; 1977.

2. Kouloheris, A.P. "Solving problems in chemical processing of low quality phosphate rock"; Eng. & Mining Journal, v. 178, No. 9, pp 104-108.

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